

Report to

Montana Board of Oil and Gas Conservation

Scope of Work

for the

Development of a Procedures Manual

and a

Field Inspection System

Work product of Montana DNRC Contract 128220,
this report is provided by

Montana Tech

and the Departments of:

Petroleum Engineering

Technical Communication

Computer Science and Software Engineering

Environmental Engineering

Safety, Health and Industrial Hygiene

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MontanaTech
THE UNIVERSITY OF MONTANA

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Introduction

The Montana Board of Oil and Gas Conservation (BOGC) is charged with regulation of the oil and gas industry within the state. As stated on the BOGC website:

The board's regulatory action serve three primary purposes: (1) to prevent waste of oil & gas resources, (2) to conserve oil & gas by encouraging maximum efficient recovery of the resource, and (3) to protect the correlative rights of the mineral owners, i.e., the right of each owner to recover its fair share of the oil & gas underlying its lands. The board also seeks to prevent oil and gas operations from harming nearby land or underground resources.

A performance audit of the Board of Oil and Gas Conservation Regulatory Program, with a report dated September 2011, was conducted by the Montana Legislative Audit Division. That document provided a total of seven recommendations designed to respond to the concerns stated in the audit report summary as follows:

“The Board of Oil and Gas Conservation must improve its inspections and enforcement processes to more effectively regulate the state’s 17,600 active oil and gas wells.”

This scoping project was initiated to assist the O&G Division in addressing the concerns stated in the audit report. Specifically, Montana Tech was contracted to provide the following services:

- Review pertinent documents
 - Existing procedures, documentation and forms
 - Report from the Legislative Audit Committee
 - EPA UIC manual
 - Applicable Montana Regulations
- Write specifications
 - Recommended deliverables
 - Estimate of effort
 - Draft of RFQ

These deliverables were presented first as an interim report to the BOGC at the April 26, 2012 meeting. The final report (this document) is to be submitted no later than June 30, 2012.

Definitions

Academic departments at Montana Tech of the University of Montana and associated personnel that were involved in the development of the document are referred to by their department names.

- *Petroleum Engineering*
- *Technical Communication*
- *Computer Science and Software Engineering*
- *Environmental Engineering*
- *Safety, Health and Industrial Hygiene*

COGCC refers to the Colorado Oil and Gas Conservation Commission.

FIPM refers to a Montana Field Inspection Procedures Manual that would be developed under proposed Path I.

LAD refers to the Legislative Audit Division of the State of Montana. This entity is the author of the report that includes recommendations for modifications to the business practices and field inspection procedures of the Oil and Gas Division of the Department of Natural Resources.

MBOGC refers to the Montana Board of Oil and Gas Conservation, the citizen board with supervisory responsibility of the O&G Division.

MTST refers to the Montana Tech Scoping Team, the faculty group organized to conduct this scoping study.

O&G Division refers to the Oil and Gas Division of the Montana Department of Natural Resources and Conservation. This organization is responsible for the day-to-day operation of the oil and gas interests of the State of Montana and is supervised by the Montana Board of Oil and Gas Conservation. The Montana Tech/DNRC contract 128220 that produced this report was initiated by the O&G Division.

RBDMS is the data base used by the O&G Division of Montana and 21 other states to store data about oil and gas well locations, permitting and production, and to meet EPA regulations for ground water protection in disposal (UIC) wells.

SITSD refers to Montana's State Information Technology Services Division

UIC refers to Underground Injection Control. A UIC well is used primarily for disposal of produced fluids with no commercial value, such as brine.

Methods

The Petroleum Engineering Department served as lead on a multidisciplinary team consisting of faculty from five different departments; Petroleum Engineering, Technical Communication, Computer Science and Software Engineering, Environmental Engineering and Safety, Health and Industrial Hygiene. The goal was to bring to the project a broad range of expertise to ensure that the final product was as complete as possible and that it would provide adequate consideration to aspects of the business, safety, environmental and design-for-usability that might make up a complete and effective field inspection system.

The Montana Tech Scoping Team (MTST) team started the research with the review of several documents including the audit report, the formal response to the audit from the MBOGC staff, the MBOGC inspection forms as well as the published Montana oil and gas regulations in Rule Chapter 36.22: Oil and Gas Conservation.

A ride-along was conducted on February 16, 2012 with Field Inspection Supervisor Gary Klotz. Meeting first in his Shelby office, Mr. Klotz familiarized the members of the MTST with terminology and inspection procedures. The group then engaged in several different types of inspections regularly conducted by the State including a plugged and abandoned (P&A) well, producing gas and oil wells and a disposal well.

Additional data collection methods included:

- Interviews with several O&G Division field inspectors. These face-to-face meetings permitted valuable additional feedback from the people on the ground.
- With the goal of aligning the MTST effort with the needs of the MBOGC, administrators were interviewed both via conference calls and in face-to-face meetings, including discussions about creating and implementing a risk-based inspection system.
- To clarify the position of the Legislative Audit Division (LAD), telephone interviews were conducted with both the head of the LAD and the primary author of the report.

In an effort to broaden the view as much as possible, the inspection authorities in several different states were interviewed about their inspection systems, including Texas, North Dakota and Colorado. The dual goals of this effort was to understand the various approaches used as well as to acknowledge and verify comparisons to other state inspection systems as reported by the Legislative Audit Division of the State of Montana.

Guiding the MTST efforts were two general questions:

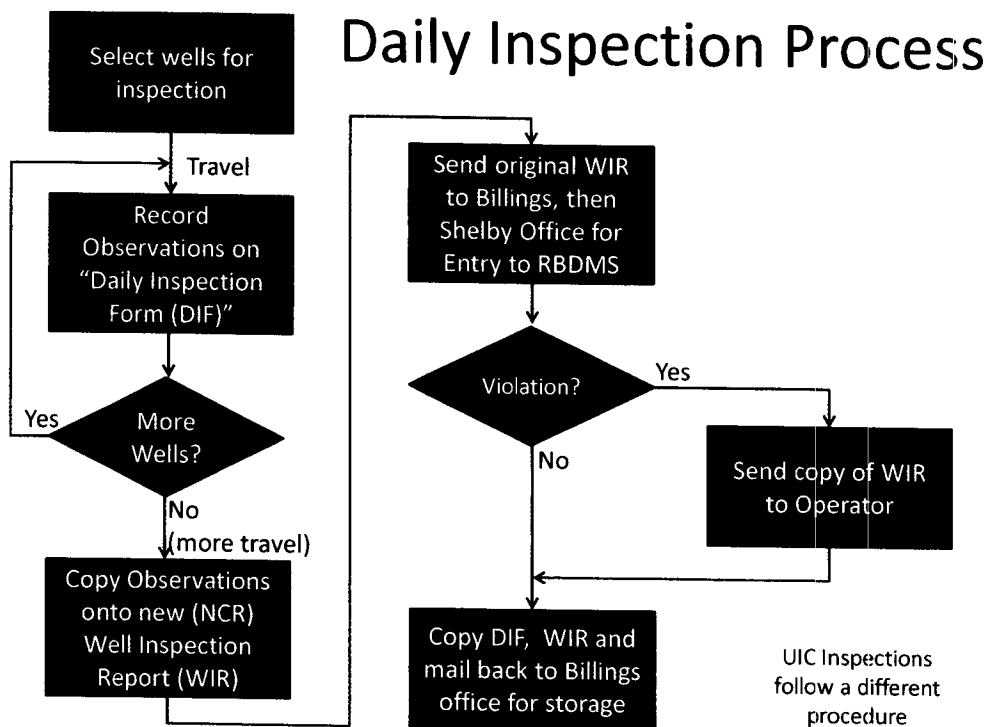
1. Specifically, what must be done to respond to the concerns stated in the LAD report?
2. How can the response to the LAD concerns be leveraged to maximize the value to the State of Montana and its citizens.

Observations and Results

It is clear that the staff responsible for Montana field inspections and enforcement is deeply invested in ensuring that the interests of all are considered, including the land owners, mineral rights owners, the public and the environment. They take seriously their mandate of conserving our natural resources and work very hard to achieve that. The MTST commends the MBOGC and specifically the O&G Division personnel for creating an environment that supports a cohesive team.

The Scoping Team's observations mirror many of those of the Legislative Audit Division with some caveats and additions.

It was observed that the existing system contains some significant redundancies that potentially contribute to sources of error and process inefficiencies. This current inspection process is diagrammed below in Figure 1.



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Figure 1 - Current Inspection Process

It was observed that the inspection process is inherently multi-media. GPS systems are used to guide the inspectors to the well locations. Cell phones provide a method to contact operator

field personnel. Hand-recorded notes of most inspection activities are documented on a Daily Inspection Form. Digital photography is used to assist in the documentation process.

O&G Division field personnel and administrators seem to be in agreement with respect to the need for some method of formal training for new inspectors. While the team has apparently enjoyed relatively low turnover, it was clear to the MTST that the process of matching observations in the field to regulatory rules is something that comes quickly only after an inspector gains substantial field

experience. The current process appears to involve considering simultaneously all of the regulations while making observations at the well site. The risks associated with achieving a 100% match between what is observed in the field and the entire suite of regulations seem to be substantial. The MTST interprets LAD recommendation number 2 to express a similar concern.

LAD Recommendation #2 We recommend the division, under the supervision of the Board of Oil and Gas Conservation:

- A. Develop formal policies and procedures pertaining to the inspection program.
- B. Ensure these policies and procedures are applied consistently by staff.

One of the recommendations of the LAD was to develop and implement a method to prioritize well inspections based on risk. Field Supervisor Gary Klotz was asked by the scoping team to provide a draft of how he would build such a priority list. He was happy to provide

one, but made it clear that the list included only two broad categories and did not further specify a priority. This first-draft list is as follows:

LAD Recommendation #1 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, develop a formal risk-based inspection approach that establishes inspection priorities.

PRIMARY INSPECTION PRIORITIES

- Spills/Leaks/Emergencies – Inspections and followup.
- Dry Hole Plugging – Witnessing and issuing plugging orders.
- UIC Program – Witness Mechanical Integrity Tests & Routine Inspections.
- Witness cementing of surface casing in new wells.
- Drilling rig/drill site inspections – equipment and site construction.
- Witness plugging of existing noncommercial oil & gas wells.
- Complaint Responses.

SECONDARY INSPECTION PRIORITIES

Evaporation Pit Inspections.

Workover/Service Rig Activities.

Change of Well Ownership Compliance Inspections.

Seismic Operation Inspections.

Oil & Gas Wells/Lease Facility Inspections for General Rules Compliance.

Inspect P&A'd Well Sites for Surface Restoration & Bond Release.

Several states were contacted by the MTST to learn about their methods and discern if there was a model that could be used to support O&G Division field inspection efforts. Below is a short summary of these contacts.

Texas RRC The Railroad Commission of the State of Texas was contacted to request a copy of their inspection manual. This document was explicitly identified by LAD staff as a benchmark for evaluating the Montana field inspection program. However, according to those contacted by the MTST, the last Texas manual update occurred nearly ten years ago. Indeed, obtaining a copy of their inspection manual required that RRC personnel scan a printed copy, since no electronic version was available. By way of explanation for that, the Texas inspection authority indicates the manual has become redundant because of the adoption of a computer-guided inspection process.

North Dakota DMR The ND Department of Mineral Resources uses a computer-assisted data collection scheme that feeds the statewide database containing inspection reports. Contacting people within the inspection authority group however was found to be more difficult than other states and in the interest of efficiency was abandoned. Follow-on efforts in response to the LAD recommendations would probably benefit from re-opening communication with the North Dakota field inspection authority.

Colorado's OGCC Significant time was spent interviewing various people in the inspection group within the Colorado Oil and Gas Conservation Commission. The COGCC recently developed and implemented a computer-assisted inspection system that obviates the need for a field inspection manual and therefore they were not able to provide one for us to review. The manager of Colorado's field inspection unit, Margaret Ash, was most helpful in providing access to the IT people that created their system. They report that "substantial effort" was allocated to designing and implementing the current system, requiring about 300 hours of development and a \$350,000 budget to fund the project. Their system, implemented on "Tough-Books" with GPS, broadband access and a camera, uses branching techniques to guide the inspector through the regulations most likely to apply based on historical data and observations made at the well site. At least one operating company has automated a work-order generation

process based on the electronic inspection notification delivered electronically by the State of Colorado.

The technical director for the national Ground Water Protection Council, Paul Jehn, was tapped to provide some guidance on where the inspection process is headed with respect to disposal wells. Mr. Jehn made a couple of points. Several states (he cited specifically Oklahoma) are rolling out computer-aided data collection methods. However, he said that careful design of those systems is crucial to success, since the inspection process is too diverse for a flat, step-by-step process to be workable.

In interviews, both the O&G Division Administrator, Tom Richmond and the Petroleum Geologist, Jim Halvorson made convincing arguments for responding to the LAD concerns by creating first a field inspection manual and updating the paper-based business processes currently in use. The existing processes and the Risk Based Data Management System (RBDMS) serve as a strong foundation. The success of these processes supports their position that an incremental approach of developing a field inspection manual first can provide the shortest path to addressing the concerns of the LAD.

They also express concern about the process of implementing a computer solution prompting untenable mandates from the State of Montana information technology group, SITSD. The existing data base represents a significant investment on the part of the O&G Division. Leveraging this investment into the future is seen as crucial to realizing the O&G Division's mission, including satisfying on-going Federal regulations. If State IT rules are unbendingly applied to this resource, fitting this system into the existing State infrastructure represents a significant risk to that ongoing mission.

Discussion

In the opinion of the MTST the primary driver of the success of the inspection program has been the longevity and dedication of the current crop of field inspectors and their support and administrative staff. While this approach has worked well, there is risk to the system primarily because the current informal procedures for inspections appear to take a long time to learn. This is likely to be exacerbated by the expected retirement of several of the current inspectors, which also tend to be the most efficient. Aside from the risk, the MTST sees this as an opportunity for significant change in the procedures as well

The concerns of the department administration about implementing a smooth transition to a computer-assisted inspection system are, in the opinion of the scoping team, reasonable. A recent research paper on this topic put it quite succinctly:

“IT and business strategies should complement and support each other relative to the business environment. Strategy development should be a two-way process between IT and business. However, we have yet to learn how to do this.” (Smith, McKeen, and Singh 49-58)

In order to achieve the recommendations of the LAD, the O&G Division will be a need to develop and foster a collaborative environment with the SITSD. The MTST recognizes that significant buy-in, and indeed resources, from the SITSD will be required.

The MTST identified two distinct, but we believe interconnected, paths to address the concerns of the LAD. The first is to focus on updating the business processes currently in use for field inspections by developing a printed field inspection procedures manual and associated training system, augmented by a follow-on project to implement the system in computerized forms. The second is to focus initially on the development of a computer-assisted inspection system. The interconnection between these two paths is that both will require O&G Division resources to identify the individual processes that can and should be improved. While the end goals of both of these approaches are the same, that is, creating a computer-assisted field inspection system, the depth of the investment in the required elements would likely be quite different.

The outline below provides details.

Two paths to address the recommendations of the audit

- I. Paper inspection manual with follow on computer forms
 - A. Phase 1 - Montana paper Field Inspection Procedures Manual (FIPM) and associated study of computer forms
 - i. Research and write paper manual
 - ii. Research Colorado and other state's computer forms systems for similarities and difference with Montana procedures and regulations as embodied in the paper manual
 - B. Phase 2 - Adaptation/implementation of computer forms system with on-line help edited from manual
 - i. Write concept of operations document and get buy-in from all stake holders
 - ii. Write field inspectors user manual, system administration manual, and software requirements specification for Montana Computer Forms Oil and Gas Inspection System; and get approval and budget for adaptation/implementation.
 - iii. Software design document, implementation and usability testing. Write Installation and SysOps Manual for SITSD.
 - iv. Delivery of Montana Computer Forms Inspection system to SITSD.
- II. Computer forms with manual embedded in the help links
 - i. Research Colorado and other states computer forms systems, write concept of operations document and get buy-in from all stake holders
 - ii. Write field inspector's user manual, system administration manual, and software requirements specification for Montana Computer Forms Oil and Gas Inspection System; and get approval and budget for adaptation/implementation.
 - iii. Software design document, implementation and usability testing. Write Installation and SysOps Manual for SITSD.
 - iv. Delivery of Montana Computer Forms Inspection system to O&G Division and the SITSD.

Scoping Team Recommendations

It is clear to the Montana Tech Scoping Team that, regardless of the chosen path, a significant amount of work ranging into hundreds of hours will be required to achieve the recommendations of the LAD (see Table 1, below.) It is the recommendation of the MTST that

this workload, at least in part, be contracted out. This could be as simple as the temporary hiring of a technical writer, supervised by O&G Division personnel, to implement the first part of Path I.

However the members of the MTST and the O&G Division administrators appear to be in agreement that ultimately the field inspection process needs to become computer assisted. Significant efficiencies will be gained by doing so, both in the short term by achieving the LAD recommendations at lower initial cost and in the long term by gaining efficiency in the reporting process as shown in Figure 2 below.

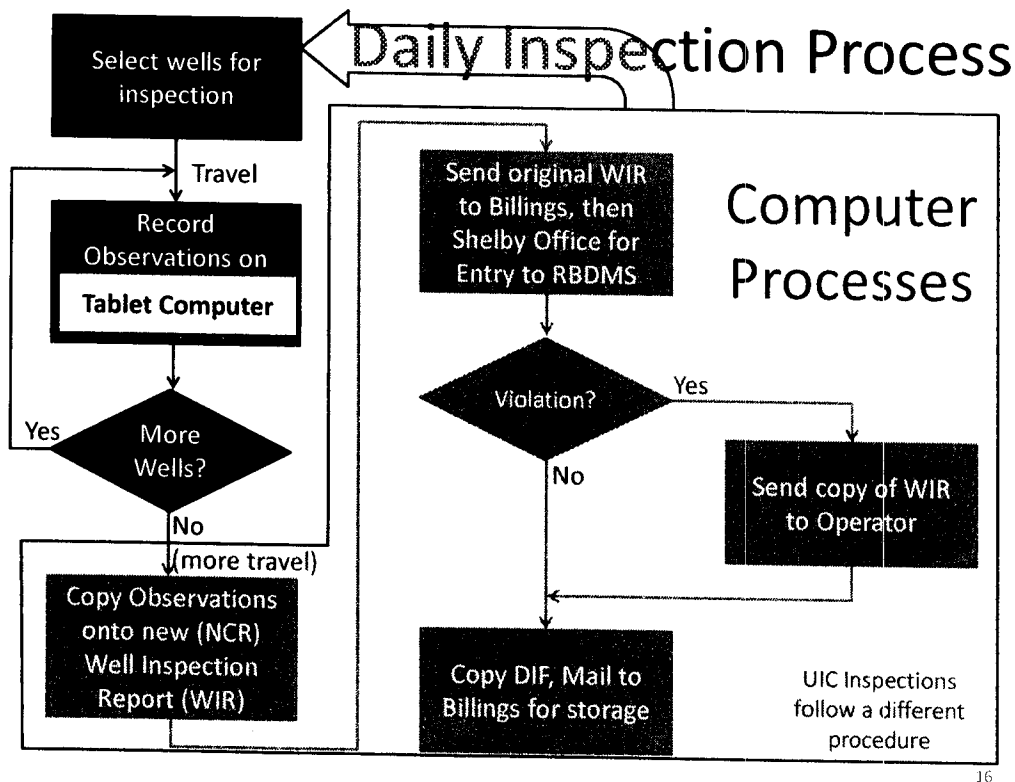


Figure 2 - Efficiencies are achieved via automation of the reporting process

While there is significant computer expertise within the O&G Division, the MTST recommends that outside consultants be contracted to design, develop and implement a computer-assisted inspection system. Several realities enter in to that recommendation, including the possibility of contracting support for the system. In any case it is expected to be a time consuming process, likely well beyond that currently available from the existing staff. Colorado was successful with a model in which one of the State information technology programmers was effectively placed on 100% assignment with their oil and gas conservation group. Leveraging

the experience gained by Colorado and others may significantly reduce the work effort required.

Based on conversations with states that have implemented a computer-assisted inspection system some desirable characteristics include the following:

- Tablet-based PC platform with a camera, GPS and broadband communication
- GPS based system to provide current location on a map of all the O&G wells in the state.
- Ability to click on a well and see all of the state-held data (inspection history, operator, depth, production history. . .)
- Ability to click on a well to be inspected and on command, have a tabbed branched, chick-listed and annotated inspection form for easy and complete entry of inspection data.
- Guided form selection, referenced to rule numbers, based on field observations.
- Ability to attach digital photographs to the well record.
- Ability to suggest other wells in the area that might be inspected, or are high risk.
- Batch update with the statewide data base after each inspection run.
- Integrated quality control structure, including computer and human verification.

Scope of Work

Table 1 below provides an estimate of the amount of time required to complete the various parts of the proposed solutions. These estimates are based on the current information available and MTST understanding of similar projects. For these reasons this scope-of-work does not represent a proposal on the part of Montana Tech to conduct the work.

This table is split into two parts, based on the path chosen to address the recommendations of the LAD. Path I is based on the development of a paper-based field inspection manual with the integrated development of a computer-assisted field inspection system. Path II assumes that training and field procedures are encoded in the software, eliminating the need for the paper procedures manual.

These estimates should be taken as a whole. Selecting items out of these tables without the recommended preceding work may under-estimate the final cost.

Table 1 – Estimate of Scope of Work for Field Inspection Manual and System

Path I - Develop Manual then Computer-assisted System				Est Hours		
Path	Proc	Sub-Proc	Task	Tech Writer	S/W Engr	O&G Div
			Develop inspection manual with following tasks:			
A.			Montana paper Field Inspection Procedures Manual (FIPM) and associated study of computer forms			
		i.	Research and write paper manual	160	40	20
		ii.	Research Colorado and other state's computer forms systems for similarities and difference with Montana procedures and regulations as embodied in the paper manual	20	40	5
B.			Adaptation/implementation of computer forms system with on-line help edited from manual			
		i.	Write concept of operations document and get buy-in from all stake holders		40	5
		ii.	Write field inspectors user manual, system administration manual, and software requirements specification for Montana Computer Forms Oil and Gas Inspection System; and get approval and budget for adaptation/implementation.	40	100	5
		iii.	Software design document, implementation (with Montana inspection help) and usability testing at Montana Tech. Write Installation and SysOps Manual for SITSD*	40	100	0
		iv.	Delivery of Montana Computer Forms Inspection system to O&G Division and SITSD	16	16	16
Total hours				276	336	51
Total Estimated Hours - Path I				663		

Path II - Develop Computer-assisted System				Est Hours		
Path	Proc	Sub-Proc	Task	Tech Writer	S/W Engr	O&G Div
II.			Computer forms with manual embedded in help links			
A.		i.	Research Colorado and other states computer forms systems, write concept of operations document and get buy-in from all stake holders	30	80	20
		ii.	Write field inspector's user manual, system administration manual, and software requirements specification for Montana Computer Forms Oil and Gas Inspection System; and get approval and budget for adaptation/implementation.	40	100	5
		iii.	Software design document, implementation (with Montana inspection help) and usability testing at Montana Tech. Write Installation and SysOps Manual for SITSD. *	40	100	0
		iv.	Delivery of Montana Computer Forms Inspection system to O&G Division and SITSD	16	16	16
Total Hours				126	296	41
Total Estimated Hours - Path II				463		

*These estimates made under the assumption that most of the software being used in Colorado, or another state that has modified the Colorado system, can be readily migrated to a Tech system and needs only to be changed to comply with the Montana inspection procedures.

For budgetary purposes, travel and other expenses should be estimated at an additional 20% above the expected hourly cost. Appropriate ruggedized field computers at government rates are about \$2,500 each, requiring an additional investment on the order of \$20,000.

Conclusion

The Performance Audit of the Board of Oil and Gas Regulatory Program conducted by the Legislative Audit Division (LAD) is viewed by the Montana Tech Scoping Team (MTST) as an opportunity to significantly enhance the efficiency and transparency of the oil and gas inspection program in Montana. However, this will not be accomplished without cost. The scope of the effort is sufficiently large that significant resources need to be allocated, which could be accomplished through hiring temporary workers or contracting the system out to an external vendor. The MTST recognizes a significant risk to the on-going operation of the O&G Division if no additional resources are allocated.

This Scoping Report provides an estimate of the time required to address the recommendations contained in the LAD report. These estimates (Table 1) assume current best-practices are used in both the computer-assisted and text-based portions of the project, from conceptualization through design and implementation. The individual elements from Table 1 may also be useful as a starting point for development of a request-for-quote. In any case, it is hoped these estimates will assist the Board of Oil and Gas Conservation in appropriately scaling resources to address the recommendations contained in the audit report from the of the Montana Legislative Audit Division.

The members of the Montana Tech Scoping Team would like to thank the Montana Department of Natural Resources and especially the Board of Oil and Gas Conservation and their administrative staff for this opportunity to be of service to Montana.

Appendix

Legislative Audit Division Recommendations

The final report of the Legislative Audit Division contained a total of seven specific recommendations.

Recommendation #1 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, develop a formal risk-based inspection approach that establishes inspection priorities.

Recommendation #2 We recommend the division, under the supervision of the Board of Oil and Gas Conservation:

- A. Develop formal policies and procedures pertaining to the inspection program.
- B. Ensure these policies and procedures are applied consistently by staff.

Recommendation #3 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, standardize how inspections and compliance activities are documented and tracked.

Recommendation #4 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, strengthen enforcement activities by:

- A. Ensuring compliance with existing administrative rule timelines.
- B. Identifying if additional corrective action timelines are needed.
- C. Establishing formal guidelines for corrective action activities.

Recommendation #5 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, comply with state information technology policy to ensure a segregation of duties over management of the Oil and Gas Information System.

Recommendation #6 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, comply with statute and state information technology policy by:

- A. Developing, documenting, and maintaining an Oil and Gas Information System security plan.
- B. Enforcing, through automated methods, the state information technology password policy for the Oil and Gas Information System.

Recommendation #7 We recommend the division, under the supervision of the Board of Oil and Gas Conservation, comply with state information technology policy by developing, documenting, testing, and maintaining an Oil and Gas Information System disaster recovery plan.

Board of Oil and Gas Conservation Response

In a July 26, 2011 letter to the Legislative Auditor Tori Hunthausen, the BOGC administrative staff provided a response to these recommendations as follows:

BOGC Response to R1, R2, R3

We concur with recommendations 1 through 3. Although we feel that these three recommendations are basically the same recommendation, we believe the division and the Board can implement the recommendations in same manner: by expanding the UIC program's inspection policies and procedures, including setting of inspection priorities, establishing standardized policies and standardizing the associated documentation. The current well inspection program has been successful in achieving compliance with the rules and regulations. It has been responsive to landowner complaints, spills, leaks and other emergencies, and it has provided the Board with reliable on-the-ground information and observations. However, improving the documentation and consistency of inspection results is desirable.

The inspection manual currently used in UIC will need to be reviewed and edited to reflect the broader scope of wells to be inspected. The UIC manual does not include oil and gas production facilities and some aspects of drilling including blow-out prevention and similar mechanical/safety requirements ordinarily inspected during drilling and those sections and other new sections will need to be written. The prioritization will also need editing to reflect more classes of wells than the injection well subset currently addressed. The use of standardized inspection forms is well on its way toward implementation; the outstanding non-standard reports and inspection priorities will be reviewed to determine if separate forms are truly needed as some other states use. It should be noted that the supervision by the Board will be policy direction and guidance to reflect the nature of the Board's meeting schedule and the available time of the minimally compensated volunteer Board.

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Biographical information on the members Montana Tech Scoping Team

Frank Ackerman, PhD.

Frank Ackerman has 50 years of experience in all phases of software development. In 1985 he founded the Institute For Zero Defect Software to do applied research, consulting, and training for software development organizations seeking to improve the quality of their software. His personal experience has led him to the conviction that today's development organizations can achieve significant improvement in software quality with increased effort. Some of his current research and educational activities are focused on improving current specification, coding, test, and review techniques for the development of high quality software. Dr. Ackerman has been active in either the Association for Computing Machinery or the IEEE Computer Society throughout his career. He is a Life Member of the IEEE. Presently he is an Associate Professor of Computer Science and Software Engineering at Montana Tech of the University of Montana. He is a graduate of the University of Chicago and holds a Ph.D. in computer science from the University of North Carolina at Chapel Hill.

Merle Benedict, PhD, MPH

Merle is an assistant professor in the Safety, Health and Industrial Hygiene department at Montana Tech. He teaches undergraduate courses in occupational safety and health and graduate courses in industrial hygiene. Merle possesses a bachelor's degree in health science from BYU-Idaho and a master's degree in industrial hygiene from the University of Michigan. He earned a Ph.D. in environmental health science also through the University of Michigan. Merle's research experience includes environmental epidemiology, reproductive health and exposure assessment. He also has industrial hygiene experience in the petroleum and healthcare industries.

William J. Drury, PhD.

Bill Drury has been on the faculty of Montana Tech of the University of Montana since 1992, where he is a Professor in the Environmental Engineering Department. He has a B.S. in Civil Engineering from Marquette University, a M.S. in Environmental Health Engineering from Northwestern University, and a Ph.D. in Civil Engineering from Montana State University. His expertise is in water and wastewater treatment and in the use environmental biotechnology for remediation purposes. He has researched the use of passive biological systems for mine drainage treatment. He is a member of the Water Environment Federation and the International Mine Water Association.

Kay Eccleston, MS

Katherine Eccleston has twenty years specialized communication and project management experience in industry and government settings. Her expertise includes technical writing and editing, document design and production, project management, and public relations. Katherine's industry experience includes researching, writing, editing, and producing technical reports, procedural documentation, software manuals, on-line documentation, proposals, and white papers. She is highly skilled in implementing communication standards and best practices. Her past work experience includes Senior Technical Writer for VLC Systems in Bozeman, Montana, Technical Writer/Editor for MSE, Inc., in Butte, Montana, Assistant Editor for the Montana Bureau of Mines and Geology, and adjunct instructor at Montana Tech. As a contract consultant, Katherine has also worked extensively with authors and subject matter experts to produce training material, technical reports and textbooks, and interpretive display materials.

For the past eight years, she has been employed as a full-time instructor in the Technical Communication Department at Montana Tech. worked at VLC, in Bozeman, Montana, Skilled at writing/editing proposals, press releases, technical reports, procedures, and white papers. Katherine holds a bachelor's degree in Society and Technology and a master's degree in Technical Communication.

John Getty, MS

John is an Instructor and Lab Director in the Petroleum Engineering Department at Montana Tech in Butte, Montana. He currently teaches Natural Gas and Production Engineering laboratory courses at Tech as well as managing the Proppant Research Division (PRD). The PRD focuses on advancing fracture stimulation technologies, providing initial evaluations of material for use as a proppant and proppant performance testing per ISO standards. After graduating from Colorado State University with a BS in Applied Physics, Mr. Getty worked in the oil and gas service sector for 10 years. Over the past 25 years he has been actively engaged in post-secondary engineering education. He recently completed a Master of Science degree in Science Education at Montana State University in Bozeman, Montana.